

Patent Claims

1. A method for fabricating a reference layer for MRAM memory cells,

5 f e a t u r i n g the following steps:

- (A) a layer system is provided for the reference layer, which layer system has a first layer (10; 100) of a material having a first Curie temperature (T_C^1), which first layer can be permanently magnetized by an external magnetic field, and a second layer (11; 101) of a material having a second Curie temperature (T_C^2), which is significantly lower than the first Curie temperature (T_C^1), which second layer can be magnetized by antiferromagnetic coupling with the first layer;
- 10 (B) an external magnetic field (B1) is generated;
- (C) the layer system (R; R') is cooled from a temperature above the first Curie temperature (T_C^1) to below the first Curie temperature (T_C^1) by action of the external magnetic field (B1), the field strength of the external magnetic field (B1) being greater than the saturation field strength of the first layer (10; 100), so that the magnetization of the first layer (10; 100) is oriented by a second-order phase transition along the field direction of the external magnetic field; and
- 20 (D) the layer system (R, R') is subsequently cooled below the second Curie temperature (T_C^2), the magnetization of the second layer (11; 101) being oriented antiparallel with respect to the magnetization of the first layer (10; 100) on account of antimagnetic coupling between the first and second layers (10; 100 and 11; 101).
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2. The fabrication method as claimed in claim 1,

w h e r e i n

- the net magnetization of the layer system (R; R') is set through the choice of the saturation flux, in particular of the layer cross section in each case of the first and second layers (10; 100 and 11; 101).
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3. The fabrication method as claimed in claim 1 or 2,

w h e r e i n

the net magnetization of the layer system (R; R') is set to

5 zero by the respectively identical net magnetization of the first layer (10; 100) and the second layer (11; 101).

4. The fabrication method as claimed in claim 1 or 2,

w h e r e i n

10 the net magnetization of the layer system (R; R') is set to be not equal to zero through selection of the second layer (11) such that the layer cross section thereof is smaller than that of the first layer (10; 100).

15 5. The fabrication method as claimed in one of the preceding claims,

w h e r e i n

in step (D), upon passing through the second Curie

temperature (T_c^2), an external magnetic field (B2) is applied

20 whose field direction is opposite to the magnetization direction of the first layer (10; 100).

6. The fabrication method as claimed in one of claims 1 to 5,

w h e r e i n

25 in step (A), a layer system (R') is provided which has a very thin intermediate coupling layer (102) between the first and second layers (100 and 101), and the antiferromagnetic coupling in step (D) is imparted by the intermediate coupling layer (102).

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7. The fabrication method as claimed in one of claims 1 to 6,

w h e r e i n

the material of the first layer (10; 100) is chosen from the group comprising (Co,Fe,Mn)₈₀(Si,B)₂₀; (Co,Fe)₈₃(Si,B)₁₇;

35 Tb₂₀Fe₄₀Co₄₀,

and the material of the second layer is chosen from the group comprising (Co,Fe,Mo)₇₃(Si,B)₂₇; (Ni,Fe)₇₈(Si,B,C)₂₂; Tb₂₀Fe₈₀.

8. The fabrication method as claimed in claim 7,
w h e r e i n
the material of the intermediate coupling layer (102) is
chosen from the group comprising ruthenium, copper, gold.

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9. An MRAM memory cell,
w h e r e i n
it has a reference layer comprising a layer system (R; R'),
which has a first layer (10; 100) of a material having a
10 first Curie temperature (T_c^1) and a second layer (11; 101) of
a material having a second Curie temperature (T_c^2), which is
significantly less than the first Curie temperature (T_c^1),
and
the reference layer is fabricated by the method described in
15 one of claims 1 to 8.